Do Watershed Programs Ensure Drought Proofing? – Evidence from Karnataka Watershed Development Agency intervention in Chitradurga, Karnataka, India

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ABSTRACT

Watershed development has been an important strategy to raise agricultural productivity. The study was conducted in Karnataka which is the third highest state in the country in the proportion of dry land area. The study examines the efficacy of watershed interventions to ensure drought proofing based on the evidence from a key bilateral project, the Karnataka Watershed Development Project (KAWAD) funded by the Department for International Development, England. The study found that the outcomes in terms of crop productivity, livestock assets and migration have been poor during the post-project year largely due to poor rainfall since the implementation of the project. The inability of watershed interventions to ensure drought proofing based on our finding provides further support to the meta-analysis study by Joshi *et al* (2005) that watershed programmes have performed well in areas with rainfall in the range of 700-1000 mm. Since the rainfall has been less than 700 mm in the study villages it is not surprising that the outcomes have been less than what one would expect. The increased variation in rainfall due to climate change further accentuates the problem and out of box solutions needs to be devised by policy makers.

Key words: Drought Proofing, Watershed Development, Rainfall, Karnataka Watershed Development Agency.

1. INTRODUCTION

Approximately, 65 per cent of India's arable land area of around 140 million hectares is classified as rainfed and face enormous challenges due to low productivity, high risk and poor adoption of modern technology/agronomic practices. But these lands is home to 61 per cent of the farmers, and account for 88 per cent of the country's grossed cropped area under pulses, 69 per cent under oilseeds and 42 per cent under paddy (Sharma, 2016 and Agriculture Census 2011). The development of dry lands requires greater attention in the context of the agrarian crisis that the country is facing since the past two decades and watershed development has been an important strategy (Kerr, Pangare and Pangare 2002). Even under an optimistic scenario of expansion of irrigation, 40 per cent of the food grain requirements in the country will have to be met from dry land agriculture. The projections however indicate that due to climate change, crop yields would tend to decline (Jat, *et.al*, 2002). The purpose of this paper is to examine the efficacy of watershed interventions when there are poor rainfall conditions from the field sites of a key bilateral funded project, The Karnataka Watershed Development Agency (KAWAD) project. The project was funded by Department of International Development, England in collaboration with Government of Karnataka and Non-Governmental Organisations. The KAWAD intervention was based on the recognition that watershed interventions by government have been un-participatory and this has been the major contributory factor for their unsustainability. The project devised various strategies to ensure better participation. These include formation of appropriate local level organisations – SHGs and Micro Watershed Development Committees (MWSDCs). The demand driven approach that was adopted in KAWAD project was expected to generate the request for a particular type of treatment from below and contribute to the process wherein farmers themselves would meet a significant proportion of the expenditure on SWC works. The attempt of the programme has been that the "micro plans for land treatment are generated by the MWSDCs in consultation with technical specialists from the project. This ensures that the plans are technically sound while, at the same time incorporating local wisdom and knowledge". (www.kawad.org).

2. METHODOLOGY

We have selected Karnataka state for our enquiry, which is the third highest state in the country in the proportion of dry land area (88%) (Shah, *et.al*, 1998: 121). Chitradurga district from Karnataka state has been selected for the study for the following reason. This is a semi-arid and backward district with 460,797 ha of area requiring watershed intervention. The mean annual rainfall in the district was 565 mm during the 1901 to 1990 period. The Karnataka Watershed Development Agency (KAWAD) project was implemented by Mysore Resettlement and Development Agency (MYRADA) an NGO that has demonstrated its capabilities in initiating participatory approaches. Chitradurga district was selected as it presented us the opportunity to compare the KAWAD project implemented under the leadership of MYRADA with the DPAP project implemented by the watershed department which was part of a larger enquiry.

The KAWAD intervention covered 20 villages in Molkalmuru taluk. These villages come under the purview of Chinnahagari Watershed. The selection of the five villages was guided by the agency that implemented the watershed programme. In one of the villages, MYRADA, one of the large NGOs in the state with considerable experience in the watershed development interventions, was the agency implementing the project. In two villages each, GUARD (Group for Urban and Rural Development) and RSC (Resource Support Centre) were the agencies implementing the project. These two NGOs were relatively inexperienced in watershed development interventions.

We have used both secondary and primary data in this study. We collected the relevant data from the project officials of the NGO, MYRADA in Molkalmur, which included details regarding the village wise information of the NGO involved in implementation, year of commencement of intervention, area treated and other details. The secondary data at the village level regarding contribution made by the farmers were collected from the work registers in the KAWAD villages. The data on rainfall was collected from the relevant offices at the *hobli* (administrative unit below the sub district level), taluk level (sub-district) and from the Drought Monitoring Cell in Bangalore.

The primary data was collected from five villages. A list of households belonging to different strata was prepared after undertaking the transect walk from upper to lower reaches of the micro watershed. In the KAWAD project villages, the information on the list of treated farmers within the purview of the sample Micro-watershed Development Committee (MWSDC) was collected from the Work Register maintained by the Book-writer of the MWSDC and the transect from the upper to lower reaches was undertaken.

The basic information of the farm households was collected during the transect walk. This information was used to stratify the households and select the sample households. Two levels of stratification were followed. At the first level, the reach of the farmer (upper or lower reach) was identified based on the location of the plot in the micro watershed. The demarcation of the watershed into upper and lower reach was done in the transect walk with the help of the cadastral maps and in discussion with key informants and officials. At the second level, farm households were classified into small, medium and large based on size of landholding.

The stratum for the study was: upper small, upper medium, upper large, lower small, lower medium and lower large. From the list of treated farm households, 25 per cent were selected from each stratum using the lottery method. Totally, 175 households were interviewed from the above six strata using a pre-tested structured interview schedule. In this paper, we examine the data on outcomes (crop productivity, livestock ownership and migration and common land development) from the study villages. We examine the outcomes from the KAWAD study villages, by comparing the year of completion of the project (2003) with the pre-project intervention year (1999).

The paper proceeds as follows. The agro-climatic conditions in KAWAD villages are outlined and we the area treated under soil and water conservation measures. We then proceed to examine the outcome variables – crop productivity, change in livestock assets and migration levels and conclude.

The total rainfall in Molkalmuru (closest rainfall station to the study villages of Marlahalli, Devarahatti and Bommalinganahalli) during 2003 was 246.77 mm with 43 rainy days as compared to a total rainfall of 854.33 mm with 54 rainy days in 1999 (Table 1). In B.G. Kere (closest to the study villages of Tumkurlahalli and Rayapura), the total rainfall was 277.6 mm in 2003 with 34 rainy days, while in 1999, the total rainfall was 626.6 mm with 39 rainy days. In all the study villages, the rainfall in 1999 was far higher than in 2003.

Table 1: Rainfall in the study villages

Month	Molkalmuru				B.G.Kere			
	QR 03	RD 03	QR 99	RD 99	QR 03	RD 03	QR 99	RD 99
January	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0
March	3.6	2	0	0	11.6	0	0	0
April	12.6	4	54	3	0	2	15.0	2
May	0	0	155.9	12	0	7	138.0	7
June	14.6	4	17.4	4	6.6	3	13.6	3
July	22.8	6	58.0	9	49	4	98.6	4
August	68.8	16	58.0	7	48	3	23.4	3
September	8.6	4	219.8	9	22.2	5	108.8	5
October	115.7	7	286.4	9	140.2	9	222.0	14
November	0	0	4.8	1	0	1	7.2	1
Dec.	0	0	0	0	0	0	0	0
Total	246.7	43	854.3	54	277.6	34	626.6	39

Source: Offices at the taluk and *hobli* (administrative unit below the taluk) level
Note: QR = quantum of rainfall in millimetres; RD = number of rainy days

About 76 per cent of the total land is the high fertile red soil. Bommalinganahalli has the highest proportion of red soil followed by Marlahalli, while it is the least in Rayapura (Table 2). The proportion of red soil is the highest among the lower medium strata, while it is the least in the upper medium strata (Table 2). Black soil is present in 9 per cent of the land and this proportion is highest in the lower medium strata. Rayapura village has the highest proportion of land with black soil. The low fertility saline alkali soil is present in 13 per cent of the land, the proportion being the highest in the upper medium strata, and the least in the lower small strata. The proportion of alkali soil is the highest in Rayapura, while Tumkurlahalli does not have any land with this low quality soil. The lowest fertility (gravely soil) was present in only 2 per cent of the land. This proportion was the highest among the upper large strata, while the lower medium and lower large strata had no plots with gravely soil.

Table 2: Distribution of land (%) by villages and soil types

Village	Red soil - highly fertile	Black soil - medium fertility	Saline alkali - low fertility	Gravely soil - low fertility	Total	Proportion of irrigated land to total
Tumkurlahalli	74	24	0	2	100	17
Marlahalli	86	7	7	0	100	38
Devarahatti	82	3	13	2	100	13
Rayapura	50	31	17	2	100	27
Bommalinganahalli	91	6	3	0	100	24

Note: Figures in parentheses are actual number of plots

Table 3: Distribution of land (%) by soil types and farm categories

Strata	Red soil - highly fertile	Black soil - medium fertility	Saline alkali - low fertility	Gravely soil - low fertility	Total	Proportion of irrigated land to total
Upper small	73	4	19	4	100	28
Upper medium	65	10	24	1	100	32
Upper large	78	4	13	5	100	23
Lower small	70	22	4	4	100	13
Lower medium	91	3	6	0	100	30
Lower large	75	11	14	0	100	26
Total	76	9	13	2	100	21

Note: Figures in parentheses are actual number of plots

Twenty-one per cent of the land owned by the KAWAD farmers was irrigated. The upper medium stratum has the highest proportion of irrigated land followed by the lower medium stratum while it is the least in the lower small stratum (13%) (Table 3). Marlahalli has the highest proportion of irrigated land followed by Rayapura, while it is the least in Devarahatti (Table 2).

3. SWC TREATMENT

The demand-driven approach for planning the watershed treatment work implied that the ridge-to-valley approach was compromised. The rationale for this approach was based on the assumption that such an approach along with a higher contribution norm would ensure the efficiency of the treatment. The technical disadvantage of not following the ridge-to-valley approach further got further worsened due to the poor quality of the SWC treatment undertaken.

The literature review on technical design reveals that water harvesting as a predominant strategy of watershed development leads to beneficial outcomes, although benefits are skewed towards households which are located in the proximity of these structures. The KAWAD guidelines in their approach to common land development state that the expected goal of the group centred and a site-specific strategy was to enable biomass development. Although there was a provision for constructing check dams and repair of existing check dams under the KAWAD project, the evidence from our study villages reveals that there was no attempt to construct check dams as farmers were not interested in the intervention. This is because of poor rainfall in the years preceding the intervention. Further, there was uncertainty of good rainfall occurring in the near future.

In the KAWAD villages, 64 per cent of the land was treated. The strata with the highest extent of treated area were lower small and upper medium strata, while it was the least in the upper small and lower large strata (Table 4). There were village - level variations. The entire land owned by the sample farmers from Devarahatti was treated, while the proportion of land treated in Marlahalli was the least. In other villages, more than 80 per cent of the land was treated (Table 5). The reason for the higher quantum of treatment in Devarahatti is due to the effort of the MYRADA NGO staff to build rapport and convince the farmers of the utility of the treatment. The treated area was the least in Marlahalli as the various actors (NGO staff, lady fixer) could maximise their wealth seeking behaviour by treating a lesser quantum of land and therefore there was no effort to bring in more land under SWC treatment.

Table 4: Quantum of area treated by farm categories and villages

Strata	Total land (acres)	Land treated (acres)	Proportion of land treated (%)	Village	Proportion of land treated (%)
Upper Small	156.98	82.33	52	Tumkurlahalli	86
Upper Medium	152.90	130.10	85	Marlahalli	62
Upper Large	248.60	196.85	79	Devarahatti	100
Lower Small	73.09	62.59	86	Rayapura	80
Lower Medium	217.49	142.35	65	Bommalinganahalli	83
Lower Large	640.50	335.60	52		
Total	1489.56	949.82	64		

4. CROP PRODUCTIVITY

In this section, we compare the productivity across the various soil and water conservation treatments carried out in the farmers' plots. We first analyse the evidence on the crop productivity of the groundnut crop in the plot in which farm bund treatment was carried out. The average productivity during 2003 kharif of groundnut was only 2.34 quintals/ha, as compared to 6.95 quintals/ha in 1999. The reason is the differential rainfall across the two periods. In the Molkalmuru substation, (which is the closest rainfall station to the study villages of Marlahalli, Bommalinganahalli and Devarahatti villages), the annual rainfall in 1999 was 644.4 mm with 39 rainy days as compared to only 230.5 mm of annual rainfall in 2003 with 37 rainy days.

The comparison of the rainfall during the Kharif (crop growing period from June to December) season is as follows. While in 2003, there was rainfall of only 230.5 mm with 37 rainy days, in 1999, although the rainy days was only marginally higher at 39 days, the quantum of rainfall was more than 250 per cent higher at 644.4 mm during the kharif crop growing period. In the B.G. Kere station, (closest to the study villages of Tumkurlahalli and Rayapura), while the rainfall (for the Kharif crop growing period from June to December) was only 266 mm with 19 rainy days in 2003, it was more than 150 per cent higher in 1999 with 473.6 mm rainfall on 25 rainy days.

The average productivity in farm bund treated plots was 2.34 quintals/ha in 2003 which was significantly lesser than in 1999 (6.95 quintals/ha). The stratum with the highest productivity in 2003 was in the lower medium and lower large strata with a productivity of 3.76 quintals/ha (Table 6). For the lower medium strata, in comparison to the 2003 productivity of 3.76 quintals/ha, the productivity in 1999 was substantially higher at 7.76 quintals per hectare and the expected productivity in a normal rainfall year (7.32 quintals per hectare). The reason for the high productivity in the lower medium strata was due to the high proportion of the fertile red soil and 30 per cent of area being irrigated. Similarly, for the lower large strata, 75 per cent of the soil was the highly fertile red soil and 26 per cent of the area was irrigated. For the lower large strata, the relative and absolute variations were higher in 2003 as compared to 1999 (standard deviation of 16.17 in 2003 as compared to 9.21 in 1999; CV of 430.05 in 2003 as compared to 177.79).

Table 5: Groundnut productivity of farm bund treated plots

Strata	2003 crop productivity (quintals/ha)	1999 crop productivity (quintals/ha)	Productivity expected under normal rainfall conditions	2003 CV	1999 CV
Upper small	1.72 (3.22)	6.85 (4.34)	8.32	187.20	63.65
Upper medium	2.47 (6.14)	7.25 (7.02)	7.18	248.58	96.82
Upper large	2.09 (3.45)	7.22 (23.56)	8.56	165.07	326.31
Lower small	3.16 (3.19)	6.23 (4.08)	12.48	100.94	65.48
Lower medium	3.76 (8.91)	7.76 (5.13)	7.32	236.96	66.10
Lower large	3.76 (16.17)	5.18 (9.21)	8.66	430.05	177.79
Total	2.34 (7.57)	6.95 (11.57)		323.50	166.47

Note: Standard deviation in parentheses

This was due to higher variation in the rainfall across the plots and villages in 2003. The strata with the lowest productivity in 2003 was the upper small strata with a productivity of 1.72 quintals/ha, which was substantially lower than the productivity in 1999, 6.85 (quintals/ha) and the expected productivity in a normal rainfall year (8.32 quintals/ha). The relative variation was higher in 1999 (standard deviation of 4.34), as compared to 2003 (standard deviation of 3.22), due to better rainfall, as certain plots with better endowment were able to achieve higher productivity.

In absolute terms, the variation (CV of 187.20 in 2003 as compared to 63.65 in 1999) was higher in 2003 due to low rainfall and higher variation as compared to 1999.

The average productivity in plots where removal of boulders activity was undertaken was 2.13 quintals/ha in 2003, which was substantially lesser than the productivity in 1999 (8.63 quintals/ha) (Table 7). The highest productivity in 2003 was in the lower large strata with a productivity of 3.80 quintals/ha. This stratum had better endowment with 75 per cent of the plots having the highly fertile red soil and 11%, the medium fertile black soil; 25.71 per cent of the land in this stratum was irrigated. The relative variation was higher in 1999 (standard deviation of 15.88 in 1999 as compared to 4.49 in 2003), as plots with better endowment were able to achieve better productivity in comparison to other plots. However, in absolute terms the variation was higher in 2003 (CV of 230.51 as compared to 145.88 in 1999) due the differential rainfall across plots and villages.

The lowest productivity in 2003 was in the lower medium stratum, with a productivity of 1.21 quintals/ha, this was despite the plots having high proportions of red soil and 30 per cent of the plots being irrigated, indicating that the deficiency in rainfall was a more crucial determinant for the lower productivity. In comparison the productivity in 1999 was 5.63 qtls/ha and the expected productivity in a normal rainfall scenario was 8.07 qtls/ha (Table 6).

Table 6: Groundnut productivity of plots with boulders removal work

Strata	2003 Productivity (Quintals/ha)	1999 Productivity (Quintals/ha)	Productivity expected under normal rainfall situation (quintals/ha)	2003 CV	1999 CV
Upper small	2.33 (9.79)	8.63 (4.69)	14.88	420.17	54.34
Upper medium	1.98 (1.26)	11.85 (4.89)	15.27	63.63	41.26
Upper large	1.32 (3.39)	7.64 (20.68)	18.73	256.81	270.68
Lower small	1.99 (1.45)	7.14 (7.73)	8.96	72.86	108.26
Lower medium	1.21 (2.13)	5.63 (8.72)	8.04	176.03	154.88
Lower large	3.80 (4.49)	8.37 (15.78)	12.00	118.51	188.53
Total	2.13 (4.91)	8.63 (12.59)		230.51	145.88

Note: Standard deviation in parentheses

The average productivity in tank silt applied plots in 2003 was 2.55 quintals/ha, as compared to substantially higher productivity of 7.88 quintals/ha in 1999. The highest productivity in 2003 was in the lower small strata (3.24 quintals/ha) (Table 7) and in this stratum 70 per cent of the soil was the highly fertile red soil and 22 per cent was the medium fertile, black soil. This was despite the stratum having the lowest proportion of area irrigated, 13 per cent, indicating that better soil endowment was a more crucial determinant for the higher productivity in these plots. The productivity in the lower small strata in 2003(3.24 quintals/ha) was lesser as compared to 1999 (6.59 quintals/ha) and the expected productivity in a normal rainfall year of 16.14 quintals/ha. The relative variation (standard deviation of 0.65 in 1999 as compared to 0.14 in 2003) and absolute variation was higher in 1999 as compared to 2003 (CV of 9.86 in 1999 as compared to 4.32 in 2003) and due to better rainfall and certain well-endowed plots were able to achieve higher productivity as compared to others.

Table 7: Groundnut productivity of plots which have applied tank silt

Strata	2003 Productivity (quintals/ha)	1999 Productivity (quintals/ha)	Productivity expected under normal rainfall situation (quintals/ha)	2003 CV	1999 CV
Upper small	1.29 (1.27)	8.06 (0.28)	9.13	98.44	226.68
Upper medium	1.67 (44.97)	7.56 (1.41)	8.13	2692.81	1065.96
Upper large	2.34 (0.8)	8.80 (3.8)	9.23	34.18	0.43
Lower small	3.24 (0.14)	6.59 (0.65)	16.14	4.32	9.86
Lower medium	2.01 (4.2)	7.02 (14.14)	8.64	208.95	201.42
Lower large	0.98 (2.8)	6.04 (3.42)	9.01	285.71	56.62
Total	2.55 (18.09)	7.88 (11.19)		709.41	142.00

Note: Standard deviation in parentheses

The least productive was the upper small stratum with productivity of 1.29 quintals/ha in 2003, which was substantially lesser than the productivity in 1999 (8.06 quintals/ha) and during the expected productivity in a normal year (9.13 qtls/year). This was despite that 73 per cent of the soil being the highly fertile red soil and 28 per cent of the area being irrigated, showing that low rainfall was a more crucial determinant resulting in lower productivity. The relative variation was higher in 2003 (standard deviation of 1.27 in 2003 in comparison to 0.28 in 1999) due to the variation in the rainfall across the plots and villages. In contrast, the absolute variation was higher in 1999 (CV of 226.68 in 1999 as compared to 98.44 in 2003) as plots with better endowment were able to achieve higher productivity in a better rainfall year.

5. LIVESTOCK ASSETS

Livestock production plays an important role in the rural economy of India’s semi-arid tropics. While on an average, 15 per cent of the household income is derived from livestock production, two-thirds of the rural poor depend on livestock for income and drought insurance (Walker and Ryan 1990). Small ruminants, in particular, play an important role in ensuring rural livelihoods in drought conditions (Pasha 2000). The following hypothesis of Puskur *et al* (2004) is tested in our KAWAD study villages.

a) For large ruminant owners (cow, buffalo and ox), the effects of a drought are not adverse as these species depend largely on crop residues and stall-feeding.

b) For ‘marginal’ land owners, who depend on the small ruminants (goat and sheep) the effects of drought are adverse, as they tend to resort to selling of goats and sheeps, as they are not able to prevent the death of the livestock due to fodder scarcity.

The inference of the data from our study villages clearly shows that this hypothesis holds true with the stock depletion of large ruminants comparatively being the least while, in the case of small ruminants, it is higher in the case of goats, while lesser among sheep. For cows, the stock depletion is the highest among the lower small strata. Among, buffaloes, the mortality was the highest among the upper small strata, with an overall depletion of 64 per cent of the stock. This was despite 28 per cent of the area being irrigated indicating that the mortality predominantly has occurred among those farmers owning dry land who had lesser crop residues compared to irrigated farmers. The extent of stock depletion of Buffaloes (due to both death and sale) is highest among farmers in the upper small strata, followed by the lower medium strata. Although 30 per cent of the land was irrigated in the lower medium strata, the farmers preferred to sell the Buffaloes during the 1999 to 2003 time period. This is due to reduced water available from the borewells.

Table 8: Changes in livestock ownership by farm categories
Proportionate increase or decline (-)

Reach	Cow	Buffalo	Ox	Goat	Sheep
Upper small	-56	-64	-21	.-97	+3
Upper medium	-37	-25	-52	-90	-91
Upper large	-46	-29	-10	-45	-61
Lower small	-62	-23	-50	-6	-45
Lower medium	-30	-33	-31	-73	-20
Lower large	-49	-10	-16	-31	-59
Total	-37.14	-29.77	-26.73	-55.78	-54.33
Stock in 1999 (Number)	560	194	318	1678	635

Contrary to the Puskur *et al* (2004) hypothesis, the ownership of goats was higher among the large farmers who also experienced higher livestock mortality, 45 per cent of the stock in the case of the upper large stratum and 31 per cent in the case of the lower large stratum. Among the lower small strata, the proportion of distress sales was the highest with 94 per cent of the stock being sold off (Table 8). The mortality of goats was very high in Tumkurlahalli with a depletion of 56 per cent of the stock. The lack of fodder from the common land in the village was recognised as a problem by the MWSDCs in the village. Some effort was put to 'close' the commons and some trenches were dug around the commons so that the livestock could not enter the common land. However, there were widespread violations of the norm, especially during the night (the trenches were not wide enough, the livestock could jump over them). So there was not enough time given for the commons to rejuvenate, this led to decreased fodder availability, which in turn led to the high mortality of goats, followed by sheep.

The distress sale and mortality of Goats is very high in Marlahalli with 91 per cent of the stock getting depleted in 1999 due to non-availability of fodder from the commons. 45 per cent of the sheep stock was either dead or sold. The lack of fodder for stall-feeding led to mortality and distress sale of ox. In Rayapura, the stock depletion of cows was high, with an overall depletion of 49 per cent of the stock, while it was 25 per cent in the case of Buffaloes. Among the smaller ruminants, the stock depletion of Sheeps was 91 per cent of the stock, while it was far lesser for goats, 26 per cent of the stock.

6. MIGRATION

Only 5 per cent of the sample households (eight) migrated in 2003 (Table 9). Half of them (four households) migrated for 3 months to irrigated areas in Challakere taluk (Chitradurga district), Bellary and Andhra Pradesh, while three households migrated for fourth months to the coffee plantation areas in Chickmangalore and one household migrated for seven months to an irrigated area in Bellary. Most of the households who reported migration belong to the small farmer category with no irrigated land, and encountered both the problems of distress sales and of mortality of livestock. About 62 per cent of the households reporting migration attributed recurring droughts as the push factor.

Table 9: Proportion of households (%) reporting migration

Strata	Households (%) reporting migration of at least one household member in 1999	Households (%) reporting migration of at least one household member in 2003
Upper small	8	13
Upper medium	10	18
Upper large	0	0
Lower small	7	0
Lower medium	0	0
Lower large	0	0
Total	4 (7)	5 (9)

Note: Figures in parentheses are actual numbers.

Only 7 households (just 4 per cent) migrated in 1999. None of the households who migrated in 2003 had migrated in 1999. Four of these households belonged to the small farmer category, while three farmers belonged to the medium farm holding category. Members in four households migrated for three months to irrigated villages in either Bellary or Davanagere districts. Fifty seven per cent of the households migrated due to drought in the preceding year, while in the case of 43 per cent households, the migration was 'regular' in nature. The duration of the migration was short term, with 80 per cent of the households migrating for three months and 20 per cent of the households for two months.

7. COMMON LAND DEVELOPMENT

In the KAWAD mode, group centred and site-specific strategies were supposed to be evolved for the development of the commons leading to overall biomass enhancement. It was expected from that the project that this would also include treatment in the upper reaches which would benefit all sections of the village community. We had hypothesised that Project Implementation Agencies, in this case NGOs, having strengths in social organisation and community mobilisation would be more successful in attempts to rejuvenate the commons

However, the evidence from the five villages where our study has been conducted and also Iyengar *et al* (2001) and Rajasekhar *et al* (2003) clearly point out that in the KAWAD mode, common land development had not taken place in any substantial way. The reason for this, based on our findings, was that farmers were more interested in privatised benefits and chose to undertake compromise of SWC treatments in their plots so that wealth could be generated from the project. Although there was provision for the construction of check dams under the project mode, none of the sample farmers preferred to construct them. This is due to the poor rainfall in the years preceding the intervention and the farmers were not very optimistic about the rainfall in the future and therefore did not have the interest to invest in water harvesting structures.

Under such a scenario, the farmers were unwilling to comply with the contribution norm of 10 per cent of the costs for common land treatment. The implication of the lack of attempt to rejuvenate the commons meant that there was lesser fodder available which has been a contributory factor for the distress sale and mortality of livestock.

8. CONCLUSION

The outcomes in terms of crop productivity, livestock assets and migration have been poor during the post-project year largely due to poor rainfall since the implementation of the project. The inability of watershed interventions to ensure drought proofing based on our finding provides further support to the finding of the meta analysis study (Joshi *et al*, 2005) that watershed programmes have performed well in areas with rainfall in the range of 700-1000 mm. Since the rainfall has been less than 700 mm in the study villages it is not surprising that the outcomes have been less than what one would expect. The increased variation in rainfall due to climate change further accentuates the problem and out of box solutions needs to be devised by policy makers.

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